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Linking Moles, Mass & Mr (Cambridge (CIE) IGCSE Chemistry): Revision Note

Exam code: 0620 & 0971

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Exam board:
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Linking moles, mass & Mr

mass of that element in **grams**

- If you had 1 mole of carbon atoms in your hand, that number of carbon atoms would have a mass of 12 g (because the A_r of carbon is 12)
  - So, one mole of helium atoms has a mass of 4 g (A_r of He is 4)
  - One mole of lithium has a mass of 7 g (A_r of Li is 7) and so on

- One mole of any compound is the **relative molecular mass** or relative formula mass in **grams**
- To find the mass of one mole of a compound, add up the relative atomic masses
  - For example, carbon dioxide has an *M*r of:

$$(1 \times C) + (2 \times O)$$

$$(1 \times 12) + (2 \times 16) = 44$$

Moles, mass and relative mass

- The number of moles of any chemical can be calculated using:

$$\textbf{Moles} = \frac{\text{mass}}{M_r}$$

- We can use the following formula triangle to convert between moles, mass in grams and the molar mass:

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same equation, but with relative atomic mass replacing M

Worked Example

What is the mass of 0.250 moles of zinc?

Answer:

- From the Periodic Table, the relative atomic mass of Zn is 65
  - So, the molar mass is 65 g / mol
- The mass is calculated by **moles x molar mass**:

0.250 mol x 65 g / mol = **16.25 g**

Worked Example

How many moles are in 2.64 g of sucrose, $C_{12}H_{22}O_{11}$ (M_r = 342)?

Answer:

- The molar m
- The number

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check for errors and you may pick up credit if you get the final answer wrong.

Calculating moles & masses

- Chemical amounts are measured in moles
- The mole, symbol mol, is the SI unit of **amount of substance**
- One mole of any substance contains the same number of the stated particles
  - This can be atoms, molecules or ions
- One mole contains **6.02×10^{23}** particles
  - This number is known as the **Avogadro constant**
- For example:
  - One mole of sodium (Na) contains 6.02×10^{23} atoms of sodium
  - One mole of hydrogen (H_2) contains 6.02×10^{23} molecules of hydrogen
  - One mole of sodium chloride (NaCl) contains 6.02×10^{23} formula units of sodium chloride

Worked Exar

For magnesium

1. Molecules i
2. Atoms in 1 m
3. Chloride ior
4. Magnesium ions in 2 moles

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$$1 \times 6.02 \times 10^{23} = 6.02 \times 10^{23} \text{ molecules}$$

2. There are 3 atoms in $MgCl_2$, so 1 mole of $MgCl_2$ contains:

$$3 \times 6.02 \times 10^{23} = 1.806 \times 10^{24} \text{ atoms}$$

3. There are 2 chloride ions in $MgCl_2$, so 1 mole of $MgCl_2$ contains:

$$2 \times 6.02 \times 10^{23} = 1.204 \times 10^{24} \text{ chloride ions}$$

4. There is 1 magnesium ion in $MgCl_2$, so 2 mole of $MgCl_2$ contains:

$$2 \times (1 \times 6.02 \times 10^{23}) = 1.204 \times 10^{24} \text{ magnesium ions}$$

Worked Example

In 15.7 g of water ($M_r = 18$):

1. How many molecules are there?
2. How many atoms are there?

Answers:

The number of molecules:

- The molar m
- The number

- There are 6.
- So, in 0.872

$$6.02 \times$$

The number of atoms:

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$3 \times 5.25 \times 10^{23} = \mathbf{1.58 \times 10^{24}}$ atoms

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Preparation of Salts

The Periodic Table & Trends

Author

Reviewer

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Caroline graduated from the University of Nottingham with a degree in Chemistry and Molecular Physics. She spent several years working as an Industrial Chemist in the automotive industry before retraining to teach. Caroline has over 12 years of experience teaching GCSE and A-level chemistry and physics. She is passionate about delivering high-quality resources to help students achieve their full potential.

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